

Name: Key

Period: _____

Date: _____

Honors Stoichiometry Practice Quiz

1. The fermentation of glucose ($C_6H_{12}O_6$) produces ethyl alcohol (C_2H_5OH) and CO_2 :



- a. How many moles of CO_2 are produced when 0.4 moles of glucose react? .4 mol gluc \rightarrow mol CO_2

$$\frac{.4 \text{ mol } C_6H_{12}O_6}{1 \text{ mol } C_6H_{12}O_6} \times \frac{2 \text{ mol } CO_2}{1 \text{ mol } C_6H_{12}O_6} = 0.8 \text{ mol } CO_2$$

- b. How many ^{grams} moles of CO_2 form when 7.5 grams of ethyl alcohol are produced?

$$\frac{7.5 \text{ g } C_2H_5OH}{46.08 \text{ g } C_2H_5OH} \times \frac{1 \text{ mol } C_2H_5OH}{1 \text{ mol } C_2H_5OH} \times \frac{2 \text{ mol } CO_2}{2 \text{ mol } C_2H_5OH} \times \frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2} = 7.16 \text{ g } CO_2$$

2. Car airbags inflate when sodium azide, NaN_3 , rapidly decomposes to its component elements:



- a. How many moles of N_2 are produced by the decomposition of 1.5 moles of NaN_3 ?

$$\frac{1.5 \text{ mol } NaN_3}{2 \text{ mol } NaN_3} \times \frac{3 \text{ mol } N_2}{1 \text{ mol } NaN_3} = 2.25 \text{ mol } N_2$$

- b. How many grams of NaN_3 are required to form 10 grams of N_2 ?

$$\frac{10 \text{ g } N_2}{28.02 \text{ g } N_2} \times \frac{1 \text{ mol } N_2}{1 \text{ mol } N_2} \times \frac{2 \text{ mol } NaN_3}{3 \text{ mol } N_2} \times \frac{65.03 \text{ g } NaN_3}{1 \text{ mol } NaN_3} = 15.47 \text{ g } NaN_3$$

3. Aspirin ($C_9H_8O_4$) is produced from salicylic acid ($C_7H_6O_3$) and acetic anhydride ($C_4H_6O_3$):



- a. What is the theoretical yield in moles of aspirin if 18.5 moles of salicylic acid reacts with 12.5 moles of acetic anhydride?

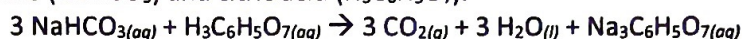
$$\frac{18.5 \text{ mol } C_7H_6O_3}{1 \text{ mol } C_7H_6O_3} \times \frac{1 \text{ mol } C_9H_8O_4}{1 \text{ mol } C_7H_6O_3} = 18.5 \text{ mol } C_9H_8O_4$$

$$\frac{12.5 \text{ mol } C_4H_6O_3}{1 \text{ mol } C_4H_6O_3} \times \frac{1 \text{ mol } C_9H_8O_4}{1 \text{ mol } C_4H_6O_3} = 12.5 \text{ mol } C_9H_8O_4 = \text{theoretical yield}$$

- b. If the situation described above produces 2000 grams of aspirin, what is the percent yield?

$$\frac{2000 \text{ g } C_9H_8O_4}{2252.13 \text{ g } C_9H_8O_4} \times 100 = 88.81\% \text{ yield}$$

4. The fizz produced when an Alka-Seltzer tablet is dissolved in water is due to the reaction between sodium bicarbonate (NaHCO_3) and citric acid ($\text{H}_3\text{C}_6\text{H}_5\text{O}_7$):



In a certain experiment, 1.00 gram of sodium bicarbonate and 1.00 gram of citric acid are allowed to react.

LR = NaHCO_3

- a. What is the limiting reagent?

$$\begin{array}{l|l|l|l} 1g \text{ NaHCO}_3 & 1 \text{ mol NaHCO}_3 & 3 \text{ mol CO}_2 & 44.01g \text{ CO}_2 \\ \hline & 84.02g \text{ NaHCO}_3 & 3 \text{ mol NaHCO}_3 & 1 \text{ mol CO}_2 \end{array} = 0.52g \text{ CO}_2$$

$$\begin{array}{l|l|l|l} 1g \text{ H}_3\text{C}_6\text{H}_5\text{O}_7 & 1 \text{ mol H}_3\text{C}_6\text{H}_5\text{O}_7 & 3 \text{ mol CO}_2 & 44.01g \text{ CO}_2 \\ \hline & 192.14g \text{ H}_3\text{C}_6\text{H}_5\text{O}_7 & 1 \text{ mol H}_3\text{C}_6\text{H}_5\text{O}_7 & 1 \text{ mol CO}_2 \end{array} = 0.69g \text{ CO}_2$$

- b. How many grams of carbon dioxide form?

0.52g (see part a)

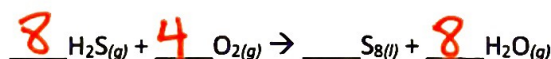
- c. How many grams of the excess reagent remain after the limiting reagent is completely consumed?

$$\begin{array}{l|l|l|l} 1g \text{ NaHCO}_3 & 1 \text{ mol NaHCO}_3 & 1 \text{ mol H}_3\text{C}_6\text{H}_5\text{O}_7 & 192.14g \text{ H}_3\text{C}_6\text{H}_5\text{O}_7 \\ \hline & 84.02g \text{ NaHCO}_3 & 3 \text{ mol NaHCO}_3 & 1 \text{ mol H}_3\text{C}_6\text{H}_5\text{O}_7 \end{array}$$

= 0.76g $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$ consumed

$$1 - .76 = \text{.24g excess left over}$$

5. Hydrogen sulfide is an impurity in natural gas that must be removed. One common removal method is called the Claus process which relies on this reaction:



Under optimal conditions, the Claus process results in a 98% yield of S_8 from H_2S . If you started with 30.0 grams of H_2S and 50 grams of O_2 , how many grams of S_8 would be produced, assuming 98% yield?

$$\begin{array}{l|l|l|l} 30g \text{ H}_2\text{S} & 1 \text{ mol H}_2\text{S} & 1 \text{ mol S}_8 & 256.8g \text{ S}_8 \\ \hline & 34.12g \text{ H}_2\text{S} & 8 \text{ mol H}_2\text{S} & 1 \text{ mol S}_8 \end{array} = 28.22g \text{ S}_8$$

$$\begin{array}{l|l|l|l} 50g \text{ O}_2 & 1 \text{ mol O}_2 & 1 \text{ mol S}_8 & 256.8g \text{ S}_8 \\ \hline & 32g \text{ O}_2 & 4 \text{ mol O}_2 & 1 \text{ mol S}_8 \end{array} = 100.31g \text{ S}_8$$

$$28.22g \text{ S}_8 \times 0.98 = \text{27.66g S}_8$$